

# SEQUENCE LISTING

<110> Panaccio, Michael  
 Rosey, Everett Lee  
 Sinistaj, Meri  
 Hasse, Detlef  
 Parsons, Jim  
 Ankenbauer, Robert G.

<120> LAWSONIA DERIVED GENE AND RELATED FLGE  
 POLYPEPTIDES, PEPTIDES AND PROTEINS AND THEIR USES

<130> DAVI150.001APC

<140> US 10/009,823

<141> 2001-11-13

<150> PCT/AU00/00437

<151> 2000-05-11

<150> US 60/133,973

<151> 1999-05-13

<160> 13

<170> FastSEQ for Windows Version 4.0

<210> 1

<211> 502

<212> PRT

<213> Lawsonia intracellularis

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| Met | Met | Gly | Ser | Leu | Phe | Ile | Gly | Ala | Thr | Gly | Met | Lys | Thr | His | Ser |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |
| Thr | Gly | Leu | Gly | Thr | Val | Ser | Asn | Asn | Ile | Ala | Asn | Ala | Asn | Thr | Ile |
|     |     | 20  |     |     |     |     |     | 25  |     |     |     |     | 30  |     |     |
| Gly | Tyr | Lys | Gln | Gln | Gln | Val | Val | Phe | Gln | Asp | Leu | Phe | Ser | Gln | Asp |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |
| Leu | Ala | Ile | Gly | Ser | Thr | Gly | Ser | Gln | Gly | Pro | Asn | Gln | Ala | Gly | Met |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |
| Gly | Ala | Gln | Val | Gly | Ser | Val | Arg | Thr | Ile | Phe | Thr | Gln | Gly | Ala | Phe |
| 65  |     |     |     |     | 70  |     |     |     | 75  |     |     |     |     |     | 80  |
| Glu | Pro | Gly | Asn | Ser | Val | Thr | Asp | Leu | Ala | Ile | Gly | Gly | Lys | Gly | Phe |
|     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |     |
| Phe | Gln | Val | Thr | Leu | Glu | Asp | Lys | Val | His | Tyr | Thr | Arg | Ala | Gly | Asn |
|     |     | 100 |     |     |     |     |     | 105 |     |     |     |     | 110 |     |     |
| Phe | Arg | Phe | Thr | Gln | Asp | Gly | Phe | Leu | Asn | Asp | Pro | Ser | Gly | Phe | Thr |
|     |     | 115 |     |     |     | 120 |     |     |     |     |     | 125 |     |     |     |
| Leu | Met | Gly | Ser | Arg | Ile | Ser | Asn | Asn | Pro | Asn | Ile | Lys | Lys | Glu | Thr |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |
| Leu | Glu | Pro | Ile | Gln | Leu | Asp | Phe | Asn | Asp | Pro | Thr | Val | Ala | Lys | Ser |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pro | Ala | Lys | Thr | Ser | Thr | Ala | Leu | Asn | Ala | Val | Val | Asn | Leu | Gly | Asp | 165 | 170 | 175 |
| Ser | Thr | Asp | Lys | Thr | Gln | Ser | Glu | Ala | Asn | Pro | Tyr | Phe | Ala | Leu | Leu | 180 | 185 | 190 |
| Glu | Ser | Trp | Lys | Gly | Asn | Gly | Thr | Pro | Pro | Ile | Ser | Thr | Ser | Asn | Tyr | 195 | 200 | 205 |
| Ser | Tyr | Ala | Gln | Pro | Met | Arg | Val | Tyr | Asp | Gln | Gln | Gly | Asn | Ser | His | 210 | 215 | 220 |
| Asp | Ile | Thr | Val | Tyr | Phe | Asp | Gly | Ala | Pro | Ser | Ser | Thr | Gly | Ser | Lys | 225 | 230 | 235 |
| Thr | Phe | Glu | Tyr | Leu | Val | Ala | Met | Asn | Pro | Ser | Glu | Asp | Gly | Ser | Ala | 245 | 250 | 255 |
| Ala | Ser | Gly | Thr | Asp | Ser | Ala | Gly | Leu | Leu | Met | Ser | Gly | Thr | Met | Thr | 260 | 265 | 270 |
| Phe | Ser | Ser | Asn | Gly | Glu | Leu | Lys | Asn | Met | Thr | Ala | Phe | Thr | Pro | Thr | 275 | 280 | 285 |
| Gly | Ser | Ala | Thr | Lys | Asp | Leu | Asn | Ala | Trp | Gln | Pro | Ala | Pro | Leu | Val | 290 | 295 | 300 |
| Asn | Gly | Leu | Pro | Gln | Phe | Ser | Ala | Asn | Phe | Val | Gly | Ala | Gly | Ile | Gln | 305 | 310 | 315 |
| Pro | Leu | Thr | Leu | Asp | Phe | Gly | Ile | Lys | Ser | Gln | Gln | Asn | Met | Trp | Ala | 325 | 330 | 335 |
| Gly | Ala | Pro | Ala | Ser | Ala | Ala | Ala | Ile | Gly | Thr | Asp | Ile | Gly | Lys | Leu | 340 | 345 | 350 |
| Pro | Ser | Met | Met | Pro | Ile | Gln | Thr | Ser | Ser | Gly | Asn | Ser | Thr | Ala | Arg | 355 | 360 | 365 |
| Asn | Gly | Ser | Ser | Ser | Thr | Arg | Arg | Tyr | Ser | Gln | Asp | Gly | Tyr | Pro | Gln | 370 | 375 | 380 |
| Gly | Asp | Leu | Val | Asp | Val | Thr | Ile | Thr | Ser | Glu | Gly | Lys | Leu | Gln | Gly | 385 | 390 | 395 |
| Lys | Tyr | Ser | Asn | Ser | Gln | Val | Val | Asp | Phe | Tyr | Asn | Ile | Pro | Leu | Ala | 405 | 410 | 415 |
| Arg | Phe | Thr | Ser | Glu | Asp | Gly | Leu | Arg | Arg | Glu | Gly | Asn | Asn | His | Tyr | 420 | 425 | 430 |
| Ser | Ala | Thr | Leu | Asp | Ser | Gly | Gly | Pro | Glu | Phe | Gly | Leu | Pro | Gly | Thr | 435 | 440 | 445 |
| Ser | Asn | Tyr | Gly | Lys | Leu | Ser | Val | Asn | Gln | Leu | Glu | Thr | Ser | Asn | Val | 450 | 455 | 460 |
| Asp | Met | Ser | Arg | Glu | Met | Val | Asn | Met | Ile | Ile | Ile | Gln | Arg | Gly | Phe | 465 | 470 | 475 |
| Gln | Met | Asn | Ser | Lys | Ser | Val | Thr | Thr | Ala | Asp | Thr | Met | Leu | Gln | Lys | 485 | 490 | 495 |
| Ala | Leu | Glu | Leu | Lys | Arg |     |     |     |     |     |     |     |     |     |     | 500 |     |     |

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| Met Met Gly Ser Leu Phe Ile Gly Ala Thr Gly Met Lys Thr His Ser |     |
| 1 5 10 15   |     |
| aca ggg ttg ggt act gtc tcc aat aat att gct aac gca aat acc att | 96  |
| Thr Gly Leu Gly Thr Val Ser Asn Asn Ile Ala Asn Ala Asn Thr Ile |     |
| 20 25 30  |     |
| ggg tat aag cag caa cag gta gtg ttt caa gac ctg ttt agt caa gat | 144 |
| Gly Tyr Lys Gln Gln Gln Val Val Phe Gln Asp Leu Phe Ser Gln Asp |     |
| 35 40 45  |     |
| tta gca ata ggt tct act gga agt cag ggg cca aac cag gct ggt atg | 192 |
| Leu Ala Ile Gly Ser Thr Gly Ser Gln Gly Pro Asn Gln Ala Gly Met |     |
| 50 55 60  |     |
| gga gca cag gtt gga agt gtt cgc aca att ttt aca cag ggt gct ttt | 240 |
| Gly Ala Gln Val Gly Ser Val Arg Thr Ile Phe Thr Gln Gly Ala Phe |     |
| 65 70 75 80   |     |
| gaa cct ggc aat agt gta aca gat ctt gct att ggt gga aaa ggt ttt | 288 |
| Glu Pro Gly Asn Ser Val Thr Asp Leu Ala Ile Gly Gly Lys Gly Phe |     |
| 85 90 95  |     |
| ttt cag gtt aca tta gag gat aaa gta cac tat aca cga gca ggg aat | 336 |
| Phe Gln Val Thr Leu Glu Asp Lys Val His Tyr Thr Arg Ala Gly Asn |     |
| 100 105 110   |     |
| ttt cgt ttt act caa gat ggt ttt tta aat gat cct agc gga ttt act | 384 |
| Phe Arg Phe Thr Gln Asp Gly Phe Leu Asn Asp Pro Ser Gly Phe Thr |     |
| 115 120 125   |     |
| tta atg ggc tca aga ata tct aat aat cct aac ata aaa aag gaa acc | 432 |
| Leu Met Gly Ser Arg Ile Ser Asn Asn Pro Asn Ile Lys Lys Glu Thr |     |
| 130 135 140   |     |
| ctt gaa cca att cag tta gac ttt aat gat cct aca gta gca aag tct | 480 |
| Leu Glu Pro Ile Gln Leu Asp Phe Asn Asp Pro Thr Val Ala Lys Ser |     |
| 145 150 155 160   |     |
| cct gca aaa aca agt aca gca tta aac gct gtg gta aac ctt ggt gat | 528 |
| Pro Ala Lys Thr Ser Thr Ala Leu Asn Ala Val Val Asn Leu Gly Asp |     |
| 165 170 175   |     |
| agt aca gat aaa aca caa agt gaa gct aat cca tac ttt gca ctt ctt | 576 |
| Ser Thr Asp Lys Thr Gln Ser Glu Ala Asn Pro Tyr Phe Ala Leu Leu |     |
| 180 185 190   |     |
| gag agc tgg aaa gga aat gga aca cct cct att tct aca tca aac tac | 624 |
| Glu Ser Trp Lys Gly Asn Gly Thr Pro Pro Ile Ser Thr Ser Asn Tyr |     |
| 195 200 205   |     |
| tca tat gca caa cct atg aga gta tat gat caa caa gga aat tct cac | 672 |
| Ser Tyr Ala Gln Pro Met Arg Val Tyr Asp Gln Gln Gly Asn Ser His |     |

| 210   | 215 | 220 |      |
|---|-----|-----|------|
| gat ata act gta tat ttt gat gga gca ccc tct tca aca gga agt aaa |     |     | 720  |
| Asp Ile Thr Val Tyr Phe Asp Gly Ala Pro Ser Ser Thr Gly Ser Lys |     |     |      |
| 225   | 230 | 235 | 240  |
| aca ttt gaa tac ctt gta gct atg aat cct agt gaa gat gga agt gct |     |     | 768  |
| Thr Phe Glu Tyr Leu Val Ala Met Asn Pro Ser Glu Asp Gly Ser Ala |     |     |      |
| 245   | 250 |     | 255  |
| gca tca gga aca gat agt gca ggt ctc tta atg tct gga act atg aca |     |     | 816  |
| Ala Ser Gly Thr Asp Ser Ala Gly Leu Leu Met Ser Gly Thr Met Thr |     |     |      |
| 260   | 265 |     | 270  |
| ttt tca agt aat ggc gaa tta aaa aat atg aca gct ttt act cct act |     |     | 864  |
| Phe Ser Ser Asn Gly Glu Leu Lys Asn Met Thr Ala Phe Thr Pro Thr |     |     |      |
| 275   | 280 |     | 285  |
| ggc tct gca aca aaa gat tta aat gca tgg caa cca gca cca tta gtc |     |     | 912  |
| Gly Ser Ala Thr Lys Asp Leu Asn Ala Trp Gln Pro Ala Pro Leu Val |     |     |      |
| 290   | 295 |     | 300  |
| aat ggt tta cca cag ttt tca gca aat ttt gtt ggt gca gga ata cag |     |     | 960  |
| Asn Gly Leu Pro Gln Phe Ser Ala Asn Phe Val Gly Ala Gly Ile Gln |     |     |      |
| 305   | 310 |     | 315  |
| cct tta aca tta gac ttt gga att aaa agc caa cag aat atg tgg gca |     |     | 1008 |
| Pro Leu Thr Leu Asp Phe Gly Ile Lys Ser Gln Gln Asn Met Trp Ala |     |     |      |
| 325   | 330 |     | 335  |
| gga gct cca gca tcc gct gct gcc ata ggt aca gat att ggg aaa ttg |     |     | 1056 |
| Gly Ala Pro Ala Ser Ala Ala Ala Ile Gly Thr Asp Ile Gly Lys Leu |     |     |      |
| 340   | 345 |     | 350  |
| cca tca atg atg cca ata caa aca tcc agc ggt aat tct aca gca aga |     |     | 1104 |
| Pro Ser Met Met Pro Ile Gln Thr Ser Ser Gly Asn Ser Thr Ala Arg |     |     |      |
| 355   | 360 |     | 365  |
| aat gga tca tct tca aca aga aga tat agc caa gat ggt tat cct cag |     |     | 1152 |
| Asn Gly Ser Ser Ser Thr Arg Arg Tyr Ser Gln Asp Gly Tyr Pro Gln |     |     |      |
| 370   | 375 |     | 380  |
| gga gat cta gta gat gtc aca att acc tct gaa ggg aaa tta caa ggt |     |     | 1200 |
| Gly Asp Leu Val Asp Val Thr Ile Thr Ser Glu Gly Lys Leu Gln Gly |     |     |      |
| 385   | 390 |     | 395  |
| aag tat agt aat agt cag gtt gtt gat ttt tat aat att cct tta gca |     |     | 1248 |
| Lys Tyr Ser Asn Ser Gln Val Val Asp Phe Tyr Asn Ile Pro Leu Ala |     |     |      |
| 405   | 410 |     | 415  |
| cgc ttt aca agt gag gat gga tta aga cga gaa ggg aat aac cat tat |     |     | 1296 |
| Arg Phe Thr Ser Glu Asp Gly Leu Arg Arg Glu Gly Asn Asn His Tyr |     |     |      |
| 420   | 425 |     | 430  |
| tcc gca aca ctt gac tca ggt ggg cca gag ttt gga ttg cca gga aca |     |     | 1344 |

Ser Ala Thr Leu Asp Ser Gly Gly Pro Glu Phe Gly Leu Pro Gly Thr  
 435 440 445

tct aac tat gga aaa ctt agt gtg aat caa ctt gag act tct aac gta 1392  
 Ser Asn Tyr Gly Lys Leu Ser Val Asn Gln Leu Glu Thr Ser Asn Val  
 450 455 460

gac atg agc aga gaa atg gtt aat atg att att att caa cgt ggt ttt 1440  
 Asp Met Ser Arg Glu Met Val Asn Met Ile Ile Ile Gln Arg Gly Phe  
 465 470 475 480

cag atg aat agt aaa tct gtt aca aca gca gac aca atg cta caa aaa 1488  
 Gln Met Asn Ser Lys Ser Val Thr Thr Ala Asp Thr Met Leu Gln Lys  
 485 490 495

gca ctt gaa cta aag cgt taa 1509  
 Ala Leu Glu Leu Lys Arg \*  
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 <213> Artificial Sequence

<220>  
 <223> Oligonucleotide primer, RA170.

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<210> 5  
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38

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<213> Artificial Sequence

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<223> Oligonucleotide primer, FlgE3'.

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40

<210> 7

<211> 477

<212> PRT

<213> Treponema phagedenis

<400> 7

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Met | Arg | Ser | Leu | Phe | Ser | Gly | Val | Ser | Gly | Met | Gln | Asn | His | Gln |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |
| Gly | Val | Asn | Pro | Lys | Glu | Val | Gly | Leu | Gly | Val | Met | Val | Ala | Ser | Gly |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |
| Val | Asn | Pro | Lys | Glu | Val | Gly | Leu | Gly | Val | Met | Val | Ala | Ser | Thr | Arg |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |
| Met | Asp | Val | Ile | Gly | Asn | Asn | Val | Ala | Asn | Val | Asn | Thr | Thr | Gly | Phe |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |
| Lys | Arg | Gly | Arg | Ile | Asp | Thr | Val | His | Thr | Gln | Gly | Ala | Leu | Gln | Thr |
| 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     | 80  |     |
| Thr | Gly | Ile | Asn | Thr | Asp | Ile | Ala | Ile | Val | Asn | Phe | Gln | Asp | Leu | Ile |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |
| Ser | Gln | Gln | Leu | Ser | Gly | Ala | Ser | Arg | Pro | Asn | Glu | Glu | Val | Gly | Gln |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |
| Gly | Asn | Gly | Phe | Phe | Ile | Leu | Lys | Asp | Gly | Glu | Lys | Ser | Phe | Tyr | Thr |
|     | 115 |     |     |     |     |     | 120 |     |     |     |     |     | 125 |     |     |
| Thr | Ala | Gly | Ala | Phe | Gly | Val | Asp | Arg | Asp | Gly | Thr | Leu | Val | Asn | Pro |
|     | 130 |     |     |     |     | 135 |     |     |     |     |     | 140 |     |     |     |
| Ala | Asn | Gly | Ala | Cys | Asn | Leu | Asp | Lys | Arg | Leu | Met | Arg | Val | Gln | Gly |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     | 160 |     |
| Trp | Met | Ala | Glu | Asp | Ile | Glu | Gly | Gln | Gln | Ile | Ile | Asn | Thr | Ser | Asp |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |
| Gln | Pro | Glu | Leu | Pro | Glu | Gly | Ala | Asn | Gln | Ala | Asp | Ile | Leu | Arg | Ser |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Thr | Glu | Asp | Leu | Ile | Ile | Pro | Ile | Gly | Gln | Lys | Ile | Asp | Ala | Lys | Ala |
|     | 195 |     |     |     |     |     | 200 |     |     |     |     |     | 205 |     |     |
| Thr | Thr | Asp | Val | Ala | Tyr | Thr | Trp | Ala | Thr | Asp | Phe | Asn | Val | Tyr | Asp |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |
| Thr | Phe | Gly | Glu | Gln | His | Lys | Leu | Gln | Met | Val | Phe | Ser | Arg | Val | Pro |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     | 240 |     |
| Gly | Thr | Asn | Asn | Gln | Trp | Leu | Ala | Thr | Val | Val | Thr | Asp | Thr | Ala | Gly |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |
| Asn | Val | Thr | Ala | Pro | Asn | Val | Asp | Pro | Glu | Asn | Gln | Ala | Gly | Thr | Glu |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |
| Thr | Arg | Val | Gly | Ile | Gly | Thr | Thr | Asp | Gly | Ala | Gly | Gln | Val | Leu | Val |
|     |     |     | 275 |     |     |     | 280 |     |     |     |     |     | 285 |     |     |

Gln Ala Thr Glu Asn Thr Phe Ile Val Ser Phe Asp Asn Tyr Gly His  
 290 295 300  
 Leu Ala Ser Ser Tyr Asn Val Val Gly Ala Asn Pro Asp Glu Gly Gly  
 305 310 315 320  
 Ala Pro Thr Arg His Thr Phe Asn Ile Asn Asp Gln Ser Gly Ile Ile  
 325 330 335  
 Thr Gly Val Tyr Ser Asn Gly Ala Ser Leu Glu Gly Glu Ile Gly Thr  
 340 345 350  
 Ser Arg Asn Thr Ile Thr Gln Phe Ala Glu Arg Glu Ile Gly Gln Leu  
 355 360 365  
 Ala Leu Ala Gly Phe Ala Asn Gln Gly Gly Leu Glu Lys Ala Gly Glu  
 370 375 380  
 Ser Thr Thr Lys Ala Tyr Gln Gln Asp Gly Tyr Ala Met Gly Tyr Leu  
 385 390 395 400  
 Glu Asn Phe Lys Ile Thr Tyr Ile Gln Ser Asn Asn Ser Gly Ile Ala  
 405 410 415  
 Asn Ile Thr Val Ser Gly Val Met Gly Lys Gly Lys Leu Ile Ala Gly  
 420 425 430  
 Thr Leu Glu Met Ser Asn Val Asp Leu Thr Asp Gln Phe Thr Asp Met  
 435 440 445  
 Ile Ile Thr Gln Arg Gly Phe Gln Ala Gly Ala Lys Thr Ile Gln Thr  
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 Ser Asp Thr Met Leu Glu Thr Val Leu Asn Leu Lys Arg  
 465 470 475

<210> 8

<211> 462

<212> PRT

<213> *Treponema pallidum*

<400> 8

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 Arg Met Asp Val Ile Gly Asn Asn Val Ala Asn Val Asn Thr Thr Gly  
 35 40 45  
 Phe Lys Arg Gly Arg Ile Asp Thr Val His Thr Gln Gly Ala Leu Gln  
 50 55 60  
 Thr Thr Gly Ile Asn Thr Asp Val Ser Ile Val Asn Phe Gln Asp Leu  
 65 70 75 80  
 Ile Ser Gln Gln Leu Ser Ala Ala Ala Arg Pro Asn Glu Glu Val Gly  
 85 90 95  
 Gln Gly Ser Gly Phe Phe Val Leu Lys Ser Gly Glu Lys Thr Phe Phe  
 100 105 110  
 Thr Arg Ala Gly Ala Phe Gly Val Asp Asn Ala Gly Thr Leu Val Asn  
 115 120 125  
 Pro Ala Asn Gly Ala Cys Asn Leu Asp Lys Arg Leu Met Arg Val Gln  
 130 135 140  
 Gly Trp Met Ala Gln Asp Asp Val Ala Gly Glu Arg Leu Ile Asn Ser  
 145 150 155 160  
 Ser Ala Gln Pro Glu Leu Ala Ala Asp Ala Asn Glu Ala Asp Val Arg  
 165 170 175  
 Lys Ser Thr Gln Asp Leu Val Ile Pro Ile Gly Gln Lys Ile Asp Ala



|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Asn | Gly | Gln | Phe | Lys | Leu | Asp | Glu | Asn | Arg | Asn | Leu | Val | Asn | Met | Gln |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |
| Gly | Gln | Ile | Asn | Leu | Asn | Ser | Thr | Asp | Pro | Val | Met | Gln | Leu | Thr | Gly |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |
| Tyr | Pro | Ala | Thr | Gly | Thr | Pro | Pro | Thr | Ile | Gln | Gln | Gly | Ala | Asn | Pro |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |
| Ser | Lys | Thr | Pro | Phe | Ser | Val | Ser | Asp | Ala | Asp | Ser | Tyr | Asn | Lys | Pro |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |
| Ala | Pro | Ile | Thr | Ile | Pro | Asn | Thr | Leu | Met | Ala | Ala | Lys | Ser | Thr | Thr |
|     |     |     | 165 |     |     |     |     |     | 170 |     |     |     |     |     | 175 |
| Thr | Ala | Ser | Met | Lys | Gly | Thr | Val | Thr | Val | Tyr | Asp | Ser | Gln | Gly | Asn |
|     |     | 180 |     |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Ala | His | Asp | Met | Asn | Val | Tyr | Phe | Val | Lys | Thr | Lys | Asp | Asn | Glu | Trp |
|     | 195 |     |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |
| Ala | Val | Tyr | Thr | Gly | Gly | Thr | Val | Asn | His | Asp | Ser | Ser | Asp | Pro | Ala |
|     | 210 |     |     |     |     | 215 |     |     |     |     |     | 220 |     |     |     |
| Ala | Thr | Ala | Pro | Ile | Thr | Thr | Ala | Ser | Thr | Thr | Leu | Lys | Phe | Asn |     |
| 225 |     |     |     |     | 230 |     |     |     | 235 |     |     |     |     |     | 240 |
| Glu | Asn | Gly | Ile | Leu | Glu | Ser | Thr | Gly | Thr | Ile | Asn | Gly | Ala | Thr | Ala |
|     |     |     | 245 |     |     |     |     |     | 250 |     |     |     |     |     | 255 |
| Ala | Thr | Phe | Ser | Leu | Ser | Asn | Asn | Asp | Gly | Thr | Val | Val | Gly | Asn | Tyr |
|     |     | 260 |     |     |     |     |     | 265 |     |     |     |     | 270 |     |     |
| Ser | Asn | Glu | Gln | Glu | Phe | Leu | Asn | Ser | Met | Gln | Gln | Asn | Thr | Gly | Gln |
|     | 275 |     |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |
| Val | Leu | Gly | Gln | Ile | Val | Leu | Ala | Asn | Phe | Ala | Asn | Asn | Glu | Gly | Leu |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |
| Ala | Ser | Gln | Gly | Asp | Asn | Asn | Ile | Val | Ala | Thr | Asn | Gln | Asn | Gly | Tyr |
| 305 |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     |     | 320 |
| Lys | Pro | Gly | Asp | Leu | Val | Ser | Tyr | Gln | Ile | Val | Trp | Ala | Ala | Thr | Gln |
|     |     |     | 325 |     |     |     |     |     | 330 |     |     |     |     |     | 335 |
| Ala | Ser | Gly | Val | Ala | Leu | Leu | Gly | Thr | Ala | Gly | Ser | Gly | Asn | Phe | Gly |
|     |     | 340 |     |     |     |     |     | 345 |     |     |     |     | 350 |     |     |
| Lys | Leu | Thr | Asn | Gly | Ala | Leu | Glu | Ala | Ser | Asn | Val | Asp | Leu | Ser | Lys |
|     | 355 |     |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |
| Glu | Leu | Val | Asn | Met | Ile | Val | Ala | Gln | Arg | Asn | Tyr | Gln | Ser | Asn | Ala |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |
| Gln | Thr | Ile | Lys | Thr | Gln | Asp | Gln | Ile | Leu | Asn | Thr | Leu | Val | Asn | Leu |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |
| Arg |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

<210> 10  
 <211> 400  
 <212> PRT  
 <213> Escherichia coli

<220>  
 <221> VARIANT  
 <222> (1)...(400)  
 <223> Xaa = Any Amino Acid

<400> 10  
 Met Ala Phe Ser Gln Ala Val Ser Gly Leu Asn Ala Ala Ala Gly Ser  
 1 5 10 15

Lys Val Gly Leu Gly Val Lys Val Ala Gly Thr Asn Leu Asp Val Ile  
                   20                                  25                                  30  
 Gly Asn Asn Ile Ala Asn Ser Ala Thr Tyr Gly Phe Lys Ser Gly Thr  
                   35                                  40                                  45  
 Ile Thr Gln Asp Phe Thr Asp Gly Thr Thr Thr Asn Thr Gly Thr Gly  
                   50                                  55                                  60  
 Leu Asp Val Ala Ile Ala Ser Phe Ala Asp Met Phe Ala Ser Gln Asn  
 65                                  70                                  75                                  80  
 Gly Phe Phe Arg Leu Val Asp Ser Asn Gly Ser Val Phe Tyr Ser Arg  
                   85                                  90                                  95  
 Asn Gly Gln Phe Lys Leu Asp Glu Asn Arg Asn Leu Val Asn Met Gln  
                   100                                  105                                  110  
 Gly Gln Ile Asn Leu Asn Ser Ser Asp Pro Leu Leu Gln Leu Thr Gly  
                   115                                  120                                  125  
 Tyr Pro Ala Thr Gly Thr Pro Pro Thr Ile Gln Gln Gly Ala Asn Pro  
 130                                  135                                  140  
 Thr Val Thr Pro Phe Ser Ala Ser Asn Ala Asp Ser Tyr Asn Lys Pro  
 145                                  150                                  155                                  160  
 Thr Asn Ile Ser Ile Pro Asn Thr Leu Met Ala Ala Lys Thr Thr Thr  
                   165                                  170                                  175  
 Thr Ala Ser Met Lys Gly Ser Val Thr Val Phe Asp Ser Gln Gly Asn  
                   180                                  185                                  190  
 Ala His Asp Met Xaa Val Tyr Phe Val Lys Thr Gly Thr Asn Gln Trp  
 195                                  200                                  205  
 Lys Val Tyr Phe Gly Ala Met Ala Asn Asn Gln Asp Ser Ser Asp Pro  
 210                                  215                                  220  
 Asn Ser Ile Ala Lys Ile Ala Thr Ala Thr Thr Leu Glu Phe Asn Ala  
 225                                  230                                  235                                  240  
 Asn Gly Thr Leu Val Asp Thr Gly Ala Ile Asn Gly Ala Glu Pro Ala  
                   245                                  250                                  255  
 Thr Phe Ser Leu Ser Asn Asp Asp Gly Thr Val Val Gly Asn Tyr Ser  
                   260                                  265                                  270  
 Asn Glu Gln Thr Phe Leu Asn Ser Met Gln Gln Asn Thr Gly Gln Leu  
                   275                                  280                                  285  
 Leu Gly Gln Ile Val Leu Ala Asn Phe Ala Asn Asn Glu Gly Leu Ala  
 290                                  295                                  300  
 Ser Glu Gly Asp Asn Asn Ile Val Ala Thr Thr Gln Asn Gly Tyr Lys  
 305                                  310                                  315                                  320  
 Pro Gly Asp Leu Val Ser Tyr Gln Ile Val Trp Ser Ala Thr Gln Ser  
                   325                                  330                                  335  
 Ser Gly Val Ala Leu Leu Gly Thr Ala Gly Thr Gly Asn Phe Gly Thr  
                   340                                  345                                  350  
 Leu Thr Asn Gly Ala Leu Glu Ala Ser Asn Val Asp Leu Ser Lys Glu  
                   355                                  360                                  365  
 Leu Val Asn Met Ile Val Ala Gln Arg Asn Tyr Gln Ser Asn Ala Gln  
 370                                  375                                  380  
 Thr Ile Lys Thr Gln Asp Gln Ile Leu Asn Thr Leu Val Asn Leu Arg  
 385                                  390                                  395                                  400

<210> 11

<211> 480

<212> PRT

<213> Aquifex aeolicus

<400> 11

Met Leu Arg Ser Phe Tyr Asn Ala Ile Thr Gly Met Asp Val Ser Arg  
1 5 10 15  
Gly Thr Val Lys Thr Thr Thr Phe Gly Ala Gly Ala Val Val Asp Ser  
20 25 30  
Phe Ala Leu Asp Val Thr Ser Asp Asn Leu Ala Asn Ala Asn Thr Val  
35 40 45  
Gly Phe Lys Lys Ser Arg Thr Gln Lys Val Trp Thr Ile Gly Ser Phe  
50 55 60  
Lys Gln Thr Glu Ile Thr Thr Asp Leu Ala Ile Pro Ile Phe Gln Asp  
65 70 75 80  
Met Val Ser Gln Val Val Val Gly Leu Asn Thr Thr Thr Glu Gly Lys  
85 90 95  
Ala Leu Phe Ile Leu Arg Asp Val Leu Thr Asn Gln Thr Tyr Tyr Thr  
100 105 110  
Arg Asp Gly Arg Phe Arg Ile Asn Arg Glu Gly Tyr Leu Ile Asn Pro  
115 120 125  
Asn Gly Pro Thr Asn Leu Asp Glu Arg Ala Pro Ile Leu Tyr Val Gln  
130 135 140  
Gly Phe Lys Val Asn Pro Val Thr Gly Glu Val Thr Gly Thr Gln Ile  
145 150 155 160  
Asp Gln Thr Thr Thr Pro Phe Asn Pro Leu Asp Ser Phe Thr Tyr Asn  
165 170 175  
Tyr Leu Glu Asp Ile Arg Val Glu Thr Gln Ile Pro Pro Lys Ala Thr  
180 185 190  
Gly Glu Ile Tyr Phe Asn Pro Arg Tyr Thr Leu Thr Ile Tyr Asp Ser  
195 200 205  
Leu Gly Arg Glu Val Pro Ala Asp Ile Tyr Phe Val Lys Thr Gly Thr  
210 215 220  
Asn Gln Trp Lys Val Tyr Phe Thr Leu Pro Thr Phe Ala Ser Lys Thr  
225 230 235 240  
Leu Glu Phe Asp Pro Ser Thr Leu Ala Ser Leu Lys Glu Arg Tyr Ile  
245 250 255  
Asn Val Asp Trp Asn Gly Asp Asp Asp Lys Gly Lys Leu Val Tyr Ile  
260 265 270  
Pro Gly Gly Asp Ile Val Gln Asp Thr Ala Asn Gln Lys Phe Tyr Leu  
275 280 285  
Thr Asp Ile Val Phe Leu Asp Leu Phe Asn Asp Gln Val His Ile Ala  
290 295 300  
Asp Asn Gly Thr Phe Ser Glu Val Asp Leu Thr Pro Glu Ser Gly Pro  
305 310 315 320  
Ser Glu Ile Asn Asp Pro Asn Asp Thr Glu Ser Tyr Leu Asn Lys Leu  
325 330 335  
Gly Ala Lys Leu Gly Ser Glu Thr Asn Lys Ile Lys Leu Ser Glu Asp  
340 345 350  
Gly Val Val Val Gly Val Tyr Ser Asn Gly Glu Thr Ile Tyr Val Gly  
355 360 365  
Glu Gly Ile Leu Gln Asn Asn Val Ile Gln Asn Ser Tyr Ile Thr Gln  
370 375 380  
His Ala Leu Pro Thr Tyr Arg Leu Ala Leu Ala Gln Phe Thr Asp Pro  
385 390 395 400  
Glu Glu Leu Val Lys Lys Gly Ser Asp Phe Val Val Thr Met Asp Gln  
405 410 415  
Asp Gly Tyr Ala Arg Gly Glu Leu Ile Asp Leu Tyr Val Leu Tyr Ala  
420 425 430

Ser Val Lys Thr Pro Thr Ile Leu Leu Pro Gly Gly Ser Asn Lys Ile  
 435 440 445  
 Arg Ser Ala Val Val Glu Met Ser Asn Val Asp Ile Ala Lys Glu Phe  
 450 455 460  
 Ile Asn Leu Ile Thr Ala Gln Arg Thr Tyr Gln Val Thr Gln Gly Arg  
 465 470 475 480

<210> 12  
 <211> 360  
 <212> PRT  
 <213> *Vibrio parahaemoliticus*

<400> 12  
 Met Ser Phe Asn Ile Ala Leu Ser Gly Leu Asp Ala Thr Asn Gly Met  
 1 5 10 15  
 Gln Pro Gly Gly Val Glu Val Ala Ser Thr Glu Leu Asn Thr Ile Ser  
 20 25 30  
 His His Ile Ala Asn Ala Ser Thr Tyr Gly Phe Lys Gly Ala Arg Ile  
 35 40 45  
 Ser Gln Asn Phe Asp Lys Asn Gly Ser Ile Thr Gly Thr Gly Arg Ser  
 50 55 60  
 Met Asp Leu Ala Ile Thr Glu Phe Ala Ala Val Tyr Asn Asn Gly Ser  
 65 70 75 80  
 Gly Phe Phe Val Thr Lys Asp His Met Gly Gln Thr Leu Tyr Thr Arg  
 85 90 95  
 Ser Gly Val Phe Gly Thr Asp Lys Ser Asn Phe Val Thr Ala Asn Asn  
 100 105 110  
 Gly Val Ala Asn Phe Asp Ala Ser Ala Lys Ala Ala Lys Leu Gln Gly  
 115 120 125  
 Tyr Ser Val Asp Ser Asn Asn Asn Leu Met Thr Gly Ser Ile Asp Lys  
 130 135 140  
 Ala Val Thr Pro Phe Asp Pro Ala Asp Pro Thr Ser Phe Asn Ser Val  
 145 150 155 160  
 Gly Asn Ile Gln Val Ser Thr Ser Ser Leu Asn Ala Lys Ala Thr Asp  
 165 170 175  
 Lys Leu Asp Phe Ser Tyr Thr Thr Gln Val Tyr Asp Ser Leu Gly Asn  
 180 185 190  
 Ser His Thr Val Thr Gln Tyr Phe Thr Lys Thr Ala Asp Asn Ala Trp  
 195 200 205  
 Glu Val Asn Val Pro Thr Gly Ser Phe Asn Gln Val Asp Gly Gly Lys  
 210 215 220  
 Thr Pro Val Val Ser Thr Ile Pro Val Thr Phe Asn Lys Asp Gly Thr  
 225 230 235 240  
 Leu Ala Ala Ala Phe Pro Ala Ala Gly Ala Asn Ala Met Ser Val Asp  
 245 250 255  
 Ile Asn Glu Asp Asn Gly Met Val Tyr Ala Thr Tyr Thr Asn Gly Gln  
 260 265 270  
 Ser Leu Lys Gly Ser Thr Gln Phe Gly Ala Gln Leu Gln Gly Gln Val  
 275 280 285  
 Val Leu Ala Asp Phe Ala Asn Thr Gln Gly Leu Ala Lys Val Ser Gly  
 290 295 300  
 Phe Gly Val Ser Thr Asn Ser Pro Asn Gly Tyr Thr Ser Gly Glu Leu  
 305 310 315 320  
 Ala Gly Val Arg Val Ala Trp Thr Gln Ser Phe Ser Ser Gly Ala Pro



|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Asn | Pro | Gly | Asp | Leu | Gln | Asn | Gln | Ala | Ile | Ser | Ser | Thr | Lys | Ala |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |
| Ile | Ile | Gln | Asp | Gly | Tyr | Gly | Met | Gly | Tyr | Met | Glu | Asn | Tyr | Glu | Ile |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |
| Ile | Leu |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|     | 370 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |